

*Atmosphere and Local Environment*

The role of biomass in UK climate plans  
and effects on air pollutants  
Peter Coleman



# Structure



## Atmosphere and Local Environment

- ▶ The UK Renewable Energy Strategy
- ▶ UK Low Carbon transition plan
- ▶ the importance of linking AQ and CC policy assessments
- ▶ The UK Renewable Heat Incentive and its potential implications for air quality

- ▶ Use of impact assessment to guide policy
- ▶ Other links between air quality and climate change

Need to work in parallel with energy policy

- ▶ The UK Department for Environment Food and Rural Affairs
- ▶ Defra's over-arching purpose is to secure a healthy environment in which we and future generations can prosper. Our priorities are to:
  - ▷ Secure a healthy natural environment for us all and deal with environmental risks
  - ▷ Promote a sustainable, low-carbon and resource-efficient economy
  - ▷ Ensure a thriving farming sector and a sustainable, healthy and secure food supply
- ▶ The Atmosphere and Local Environment Programme is part of the Environment and Rural Group which includes climate change adaptation
- ▶ Policy development and implementation on energy and climate change mitigation are matters for the Department for Energy and Climate Change (DECC) formed in 2008.

# UK Renewable Energy Strategy



*Atmosphere and Local Environment*

- ▶ Published July 2009 by the UK Department of Energy and Climate change
- ▶ Committed UK to generating 15% (= 239 TWh) of energy from Renewable Sources by 2020 in compliance with the Renewable Energy Directive (2009/28/EC)
- ▶ In 2008 renewable energy provided 2.25% (= 39 TWh) of UK needs (1690 TWh)
- ▶ In 2020 energy needs projected to have decreased to 1590 TWh despite projected economic growth
- ▶ Measures led not push - indicative scenario is;
  - ▷ 10% of transport energy use ( 49 /TWh)- limited by sustainability – no biomass foreseen principally biofuels.
  - ▷ 30% of electricity (117 TWh) of which perhaps 10% from biomass
  - ▷ 12% of heat (72 TWh) of which perhaps 50 - 70% biomass derived

# Measures to boost Renewable Energy



*Atmosphere and Local Environment*

- ▶ renewable electricity generation – the Renewable Obligation Certificates are technology specific e.g. offshore wind 2 ROCs/MWh biomass in a historically coal fired power station 1 ROC/MWh LCPD, waste wood gasification plant with engines (2 ROCs) WID.
- ▶ Several 100% biomass fuelled power stations now planned IPPC.
- ▶ Feed in tariff for smaller generators unlikely to impact on biomass except one product – small CHP at 400kW.
- ▶ transport fuels decarbonisation through biofuels but concerns on sustainability
- ▶ Renewable Heat Incentive to reward the generators of renewable heat with high level of return
- ▶ Change of UK government following elections in May 2010
- ▶ New Government not yet agreed on details so may change

# UK Government energy policy



*Atmosphere and Local Environment*

## ▶ Coalition agreement states;

- ▶ We will seek to increase the target for energy from renewable sources, subject to the advice of the Climate Change Committee.
- ▶ We will establish a full system of feed-in tariffs in electricity – as well as the maintenance of banded ROCs.
- ▶ We will introduce measures to promote a huge increase in energy from waste through anaerobic digestion.
- ▶ We will encourage community-owned renewable energy schemes where local people benefit from the power produced. We will also allow communities that host renewable energy projects to keep the additional business rates they generate.

# Low Carbon Transition Plan



*Atmosphere and Local Environment*

- ▶ Government published LCTP in 2010 to establish how the detail of how the UK would achieve the strategic goals of the Renewable Energy Strategy
- ▶ The key themes were;
  - ▷ Protecting the public from immediate risk
  - ▷ Preparing for the future
  - ▷ Limiting the severity of future climate change
  - ▷ Supporting communities and individuals to play a part
  - ▷ Building a low carbon UK
- ▶ As part of this last a range of related policy documents were produced including a Low Carbon Transport Strategy and a consultation on the details of the Renewable Heat Incentive

# Renewable Heat Incentive



*Atmosphere and Local Environment*

- ▶ Current views are a plan to encourage generation of renewable heat under any technology.
- ▶ The incentive is tuned to give householders/ technology owners a return on their investment in the renewable technology; 12%.
  - ▷ <45kW 9p/kWh for 15 years deemed
  - ▷ 45 -500kW 5.5p/kWh for 15 years deemed plus 2p/kWh above deemed if metered
  - ▷ >500kW 1.6-2.5 p/kWh + 0.5 ROC/MWh metered for CHP
- ▶ Air quality criteria contained within the scheme reflecting concerns about EU limit values for PM<sub>10</sub> and NO<sub>2</sub> and target value for PM<sub>2.5</sub>
- ▶ The RHI is technology neutral so government goes not have targets for biomass uptake.
- ▶ Air quality modelling to date has been based on 38 and 50 TWh of renewable energy from biomass boilers

# Air Pollution – Action in a Changing Climate



*Atmosphere and Local Environment*

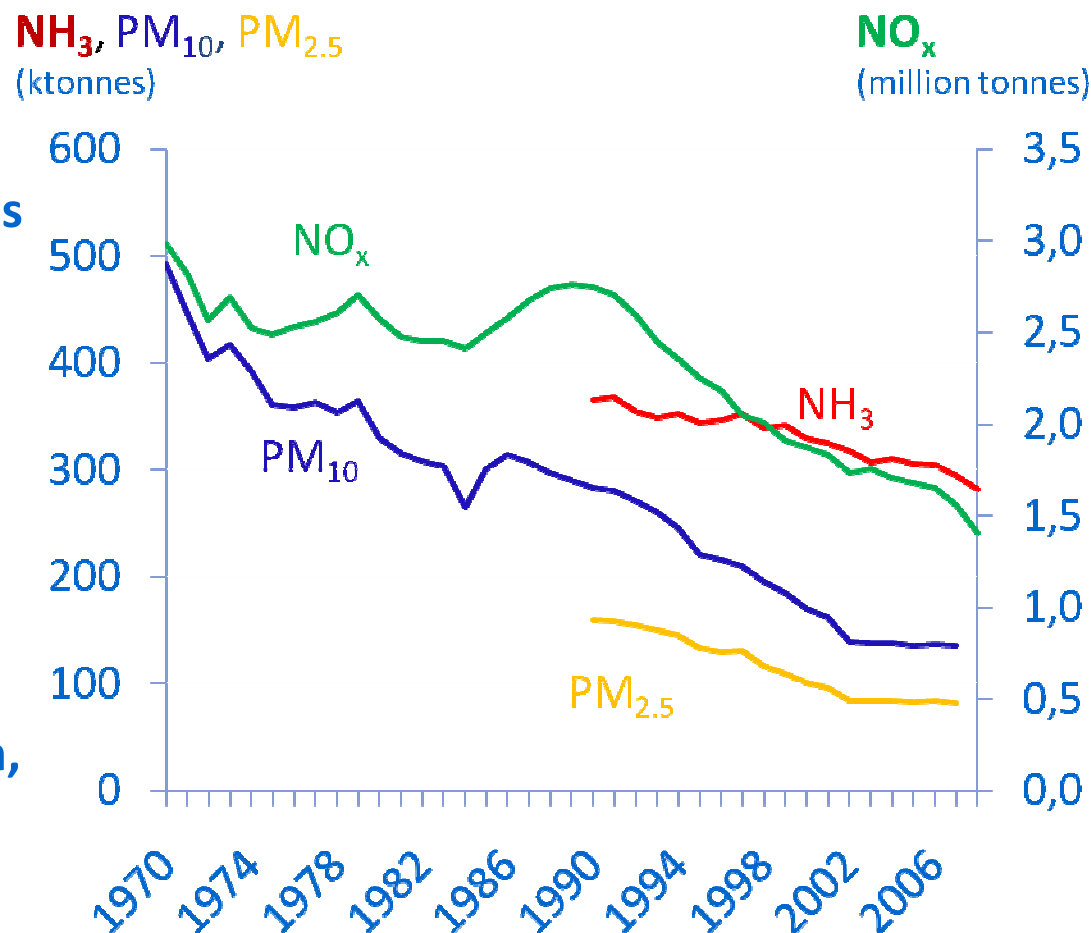
- ▶ Major climate change initiatives published or planned so an opportunity to consider the synergies and tensions with air quality and scope for further action.
- ▶ Document is directed at the policy makers across Government (national through to local) who will be developing or implementing climate change mitigation measures.
- ▶ Document is a policy summary of a large body of economic and scientific analysis, including recommendations in the Air Quality Expert Group publication 'Air Quality and Climate Change : A UK Perspective ' (2007)  
<http://www.defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-pollution.PDF>

# Air Quality in the UK is improving...



## Atmosphere and Local Environment

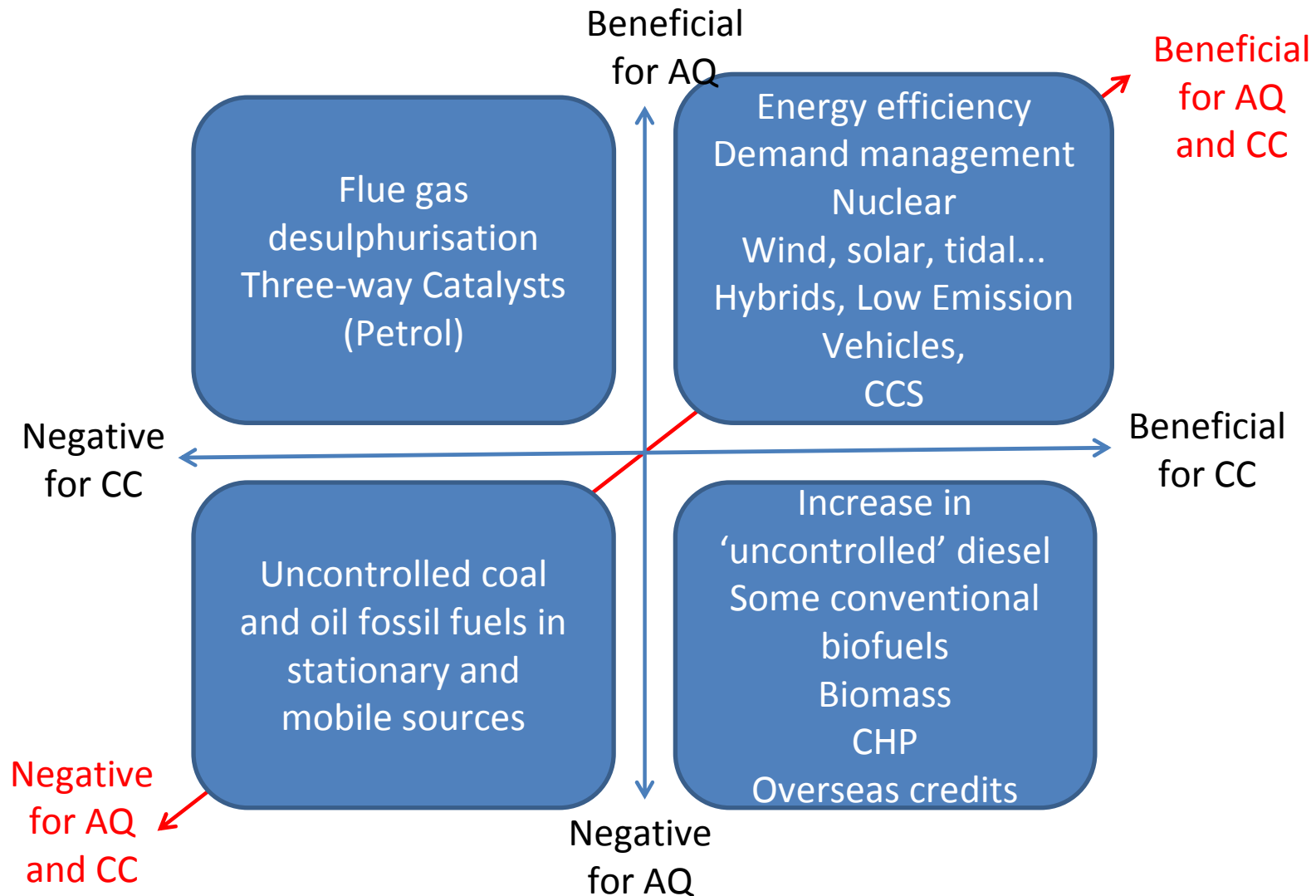
- **Reductions in emissions** have been largely due to policies targeted at **cleaner technologies and fuels**
- We have also seen a shift in the **sources of pollutants** – used to be industry and domestic heating; today dominated by large combustion plants, especially for **power generation, and by transport.**



# Policy Wins /Conflicts



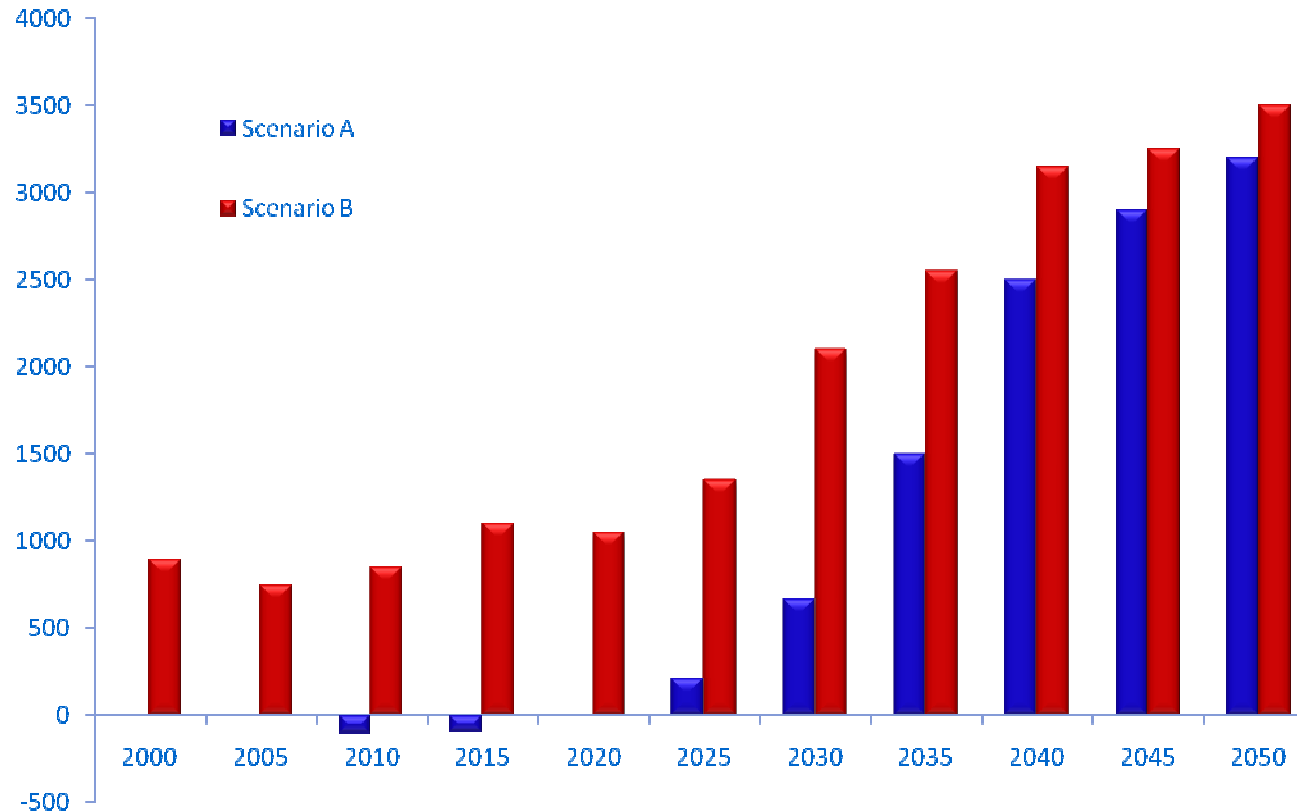
## Atmosphere and Local Environment



# Markal modelling



## Atmosphere and Local Environment



Scenario A is a solution optimised for climate benefits

Scenario B is optimised for both air quality and climate benefits

<http://www.defra.gov.uk/environment/quality/air/airquality/panels/igcb/publications>

# Key messages from AP-ACC



Atmosphere and Local Environment

- 1** Even though **air pollution has improved markedly, it still imposes annual costs of roughly £15 billion in the UK.**
- 2** Many activities, e.g. transport and energy generation, contribute to both local air pollution and global climate change. **It therefore makes sense to address these problems together and to manage trade-offs.**
- 3** Building a low carbon economy will reduce air pollution – but the extent of the reduction depends on *how* we chose to reach our 2050 targets. By selecting measures which are positive for air quality too, **we can reduce the negative impact on human health and cut the damage costs from air pollution by an additional £24 billion.**
- 4** In the short term, we are taking action to **meet our outstanding EU air quality obligations** on NO<sub>2</sub> and PM<sub>10</sub>.

# RHI AQ impacts assumptions



- ▶ UK heat generation currently dominated by gas (72%), then electricity (15%) oil (11%) and solid fuels (3%).
- ▶ Emission factors
  - ▷ Medium quality: 60g/GJ PM<sub>10</sub>, 45g/GJ PM<sub>2.5</sub>, 100g/GJ NO<sub>x</sub>
  - ▷ High quality: 20g/GJ PM<sub>10</sub>, 16g/GJ PM<sub>2.5</sub>, 50g/GJ NO<sub>x</sub>
  - ▷ Fuel and location bias
  - ▷ 60% of baseline domestic, commercial and public sector emissions from solid and liquid fuels are displaced before the remaining biomass emissions displace all fuels (including natural gas) in the commercial and public sectors
  - ▷ uptake in Air Quality Management Areas declared for PM<sub>10</sub> will be at a rate of 50%, in terms of heat demand, of that in equivalent non-AQMA squares and uptake in AQMAs declared for NO<sub>2</sub> will be at a rate of 75%

# Results: Emissions increase for commercial, residential and public sector heating



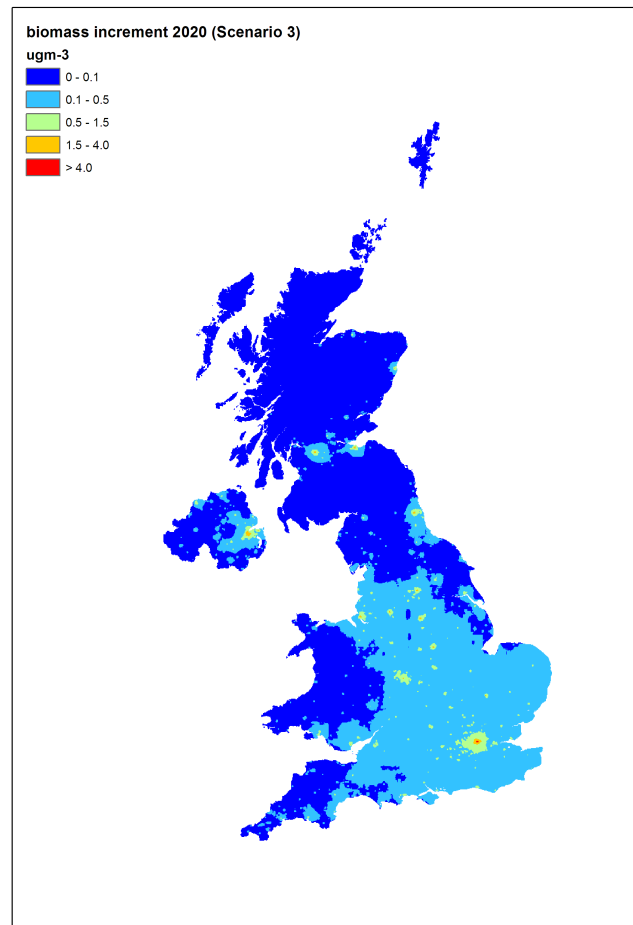
*Atmosphere and Local Environment*

Scenario	NOx 2020	PM10 2020	PM2.5 2020
1. Baseline	0%	0%	0%
2. Medium 38	8%	57%	79%
3. Medium 50	10%	72%	97%
4. High 38	1%	10%	21%
5. High 50	2%	14%	27%

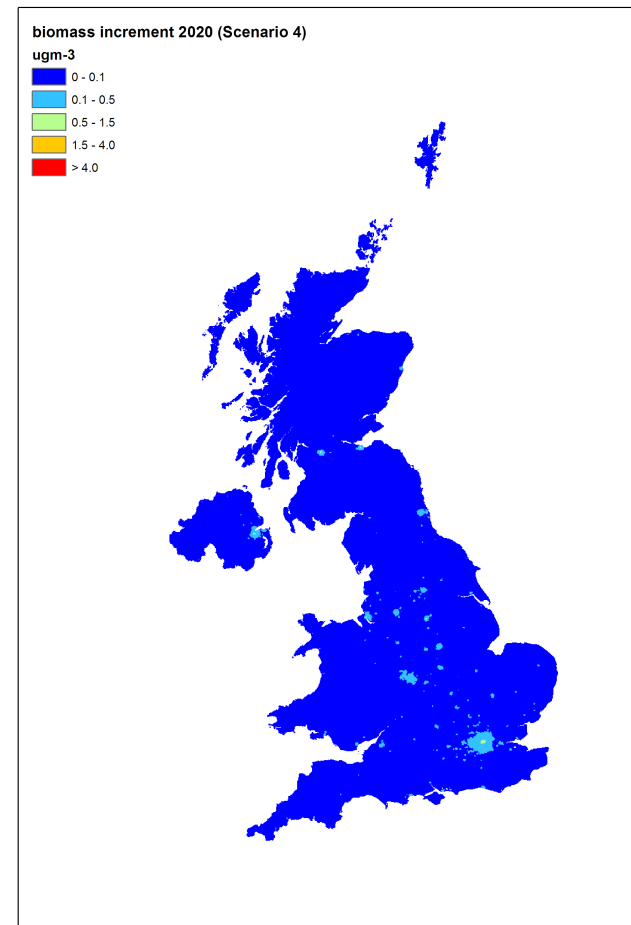
- ▶ Biomass emission factor for NO<sub>x</sub> is not very different from the fuels displaced
- ▶ Biomass emission factor for PM can be lower than some of the fuels displaced (coal, oil) but very much higher than others (gas)
- ▶ Balance results in small decreases in PM emissions at low uptake rates (2015)

# Results: PM<sub>10</sub> in 2020

a) Medium quality units, Scenario 3. Medium quality. 50TWh cap.



b) High quality units, Scenario 4. High quality, 38TWh cap.



# Results: PM<sub>10</sub> in 2020

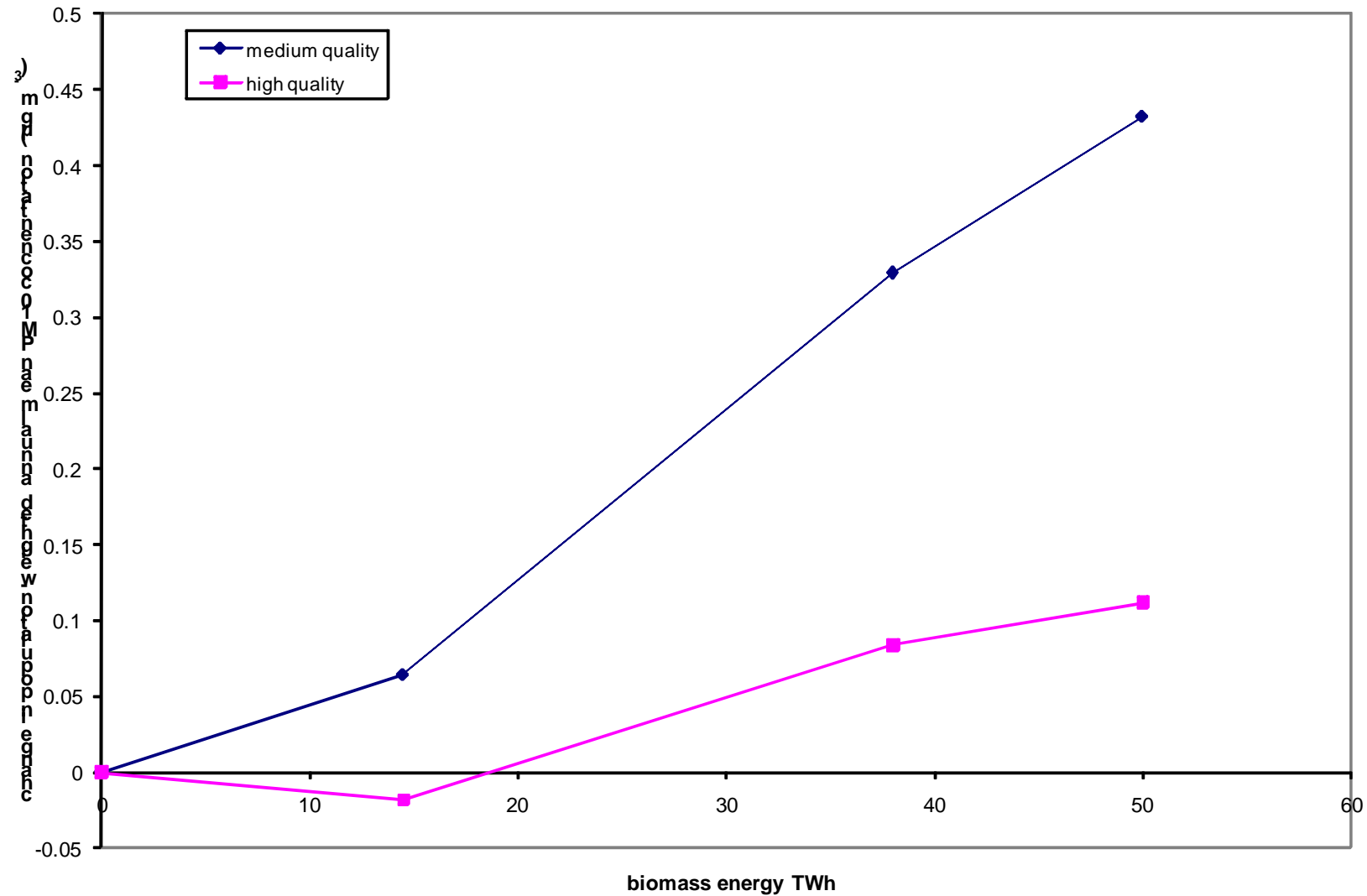


## Atmosphere and Local Environment

Predicted changes in UK population-weighted mean PM<sub>10</sub> concentration in 2020 ( $\mu\text{g m}^{-3}$ )

scenario	Change in concentration (+ve bad, -ve good)
Baseline	No change
Medium quality, 38TWh cap.	0.329
Medium quality, 50TWh cap.	0.432
High quality, 38TWh cap.	0.084
High quality, 50 TWh cap.	0.112

# Results: PM<sub>10</sub> in 2020



# Air Quality Valuation – Three methods



*Atmosphere and Local Environment*

1

The Impact  
Pathway  
Approach

The central methodology of the Inter-Departmental Group on the Costs and Benefits of Air Quality (IGCB(A))

2

Damage costs or  
Activity costs

'Short-cut' method to be used when a policy proposal has impacts less than £20 million and when the policy lifetime is less than 20 years

3

Abatement costs

To be used when a policy proposal will increase pollution above a limit value such that future abatement will be required

# IGCB: Air Quality damage costs per tonne, 2010 prices



Atmosphere and Local Environment

	<i>Central Estimate (1)</i>	<b>Sensitivities</b>			
		<i>Low Central Range (2)</i>	<i>High Central Range (2)</i>	<i>Low Sensitivity (3)</i>	<i>High Sensitivity (3)</i>
NOX	<b>£955</b>	£744	£1,085	£187	£2,164
SOX	<b>£1,633</b>	£1,320	£1,856	£520	£3,452
Ammonia	<b>£1,972</b>	£1,538	£2,241	£733	£1,069
PM Domestic	<b>£28,140</b>	£22,033	£31,978	£3,033	£79,131
PM Agriculture	<b>£9,703</b>	£7,598	£11,027	£1,046	£27,286
PM Waste	<b>£20,862</b>	£16,335	£23,708	£2,248	£58,666
PM Industry	<b>£25,229</b>	£19,753	£28,669	£2,720	£70,945
PM ESI	<b>£2,426</b>	£1,900	£2,757	£495	£6,257
PM Transport Av	<b>£48,517</b>	£37,987	£55,133	£9,897	£125,134
PM Transport Central London	<b>£221,726</b>	£173,601	£251,961	£45,229	£571,859

# Results



## Atmosphere and Local Environment

Emission Quality	Uptake	Fuel and Location bias	Km of road exceeding PM <sub>10</sub> LV 2020	PWM PM <sub>10</sub> change	PM <sub>2.5</sub> change in exposure reduction	Annual social costs in 2020 (£m)
Medium	52	N	577	-		2,803
	50	Y	20	0.432	+3.7%	732
	38	Y	9	0.329	+2.7%	557
High	52	N	138	-		731
	50	Y	3	0.112	+1%	189
	38	Y	2.5	0.084	+0.6%	142

# Conclusions



- ▶ UK will generate an increasing share of decreasing energy consumption from renewable sources; aiming for 15% in 2020
- ▶ To achieve RE targets, heat is attractive and biomass heat particularly economic to the user
- ▶ Biomass heat may increase emissions and urban concentrations.
- ▶ UK Government has agreed as part of an incentive package for renewable heat to require minimum emission standards for particles and NO<sub>x</sub> which perhaps 2/3 of modern boilers will meet depending on measurement method
- ▶ Important to engage with the energy policy makers to identify synergies and conflicts early on in the policy development process. Working together can give advantages in valuation studies.